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(71)Applicant : **NIPPON STEEL CORP**

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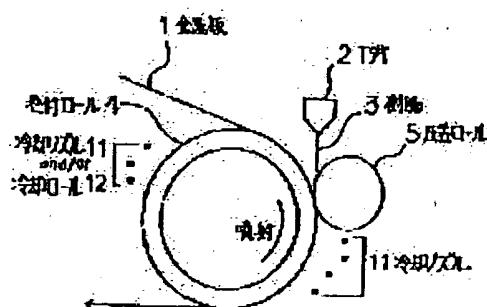
SUGIMOTO HARUHISA

(54) PRODUCTION OF LAMINATED METAL PLATE

(57)Abstract:

PURPOSE: To produce a thermoplastic resin coated metal plate excellent in close adhesion, processability, corrosion resistance and appearance in a high yield.

CONSTITUTION: A press bonding roll 4 is brought into contact with the preheated metal plate 1 wound around a winding roll 4 and a molten thermoplastic resin 3 flows down to the gap between a press bonding roll 4 and the metal plate 1 from a T-die 2 through an extruder to coat the metal plate 1 and the coated metal plate 1 is cooled to be taken up. The width of the flowing-down resin film is made larger than that of the metal plate 1 and the entire width of the metal plate 1 is coated by the central part in the lateral direction of the thermoplastic resin film and air is injected from the holes opened to the surface of the winding roll 4 to prevent the close adhesion of the thermoplastic resin film to the winding roll 4. A cooling medium is injected to the surface of the thermoplastic resin film at the part overcoated with the resin 3 or a cooling roll 12 is brought into contact with the resin overcoated part or both



end parts of the winding roll 4 at the part overcoated with the resin 3 is precooled.

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MEANS

[Means for Solving the Problem] this invention to namely, the preheated metal plate which was twisted around the roll with (1) volume In the method of carrying out the pressure welding of the sticking-by-pressure roll, flowing down the thermoplastics film fused from the T die through the extruder in the gap of a sticking-by-pressure roll and a metal plate, covering thermoplastics to a metal plate, and manufacturing a lamination metal plate While making larger than the width of face of a metal plate width of face of the thermoplastics film which flows down in the gap of a sticking-by-pressure roll and a metal plate, having it in the crosswise center section of the thermoplastics film and covering full [of a metal plate] In order to prevent the thermoplastics film which flowed down more greatly than the width of face of a metal plate twisting, and sticking to a roll, While injecting a gas from the hole in which the portion by which the overcoat was carried out twisted and the resin carried out opening on the surface of the roll, twisting this resin film and making it exfoliate from a roll The manufacture method of the lamination metal plate characterized by for a resin injecting a cooling medium on the front face of the thermoplastics film of the portion by which the overcoat was carried out, and cooling on it, [0020] (2) Carry out the pressure welding of the sticking-by-pressure roll to the preheated metal plate which was twisted around the roll with a volume. In the method of flowing down the thermoplastics film fused from the T die through the extruder in the gap of a sticking-by-pressure roll and a metal plate, covering thermoplastics to a metal plate, and manufacturing a lamination metal plate While making larger than the width of face of a metal plate width of face of the thermoplastics film which flows down in the gap of a sticking-by-pressure roll and a metal plate, having it in the

crosswise center section of the thermoplastics film and covering full [of a metal plate] In order to prevent the thermoplastics film which flowed down more greatly than the width of face of a metal plate twisting, and sticking to a roll, While injecting a gas from the hole in which the portion by which the overcoat was carried out twisted and the resin carried out opening on the surface of the roll, twisting this resin film and making it exfoliate from a roll The manufacture method of the lamination metal plate characterized by for a resin carrying out the pressure welding of the cooling roller to the front face of the thermoplastics film of the portion by which the overcoat was carried out, and cooling on it, [0021] (3) Carry out the pressure welding of the sticking-by-pressure roll to the preheated metal plate which was twisted around the roll with a volume. In the method of flowing down the thermoplastics film fused from the T die through the extruder in the gap of a sticking-by-pressure roll and a metal plate, covering thermoplastics to a metal plate, and manufacturing a lamination metal plate While making larger than the width of face of a metal plate width of face of the thermoplastics film which flows down in the gap of a sticking-by-pressure roll and a metal plate, having it in the crosswise center section of the thermoplastics film and covering full [of a metal plate] In order to prevent the thermoplastics film which flowed down more greatly than the width of face of a metal plate twisting, and sticking to a roll, While injecting a gas from the hole in which the portion by which the overcoat was carried out twisted and the resin carried out opening on the surface of the roll, twisting this resin film and making it exfoliate from a roll, a resin the crosswise both ends of the roll with a volume of a portion by which an overcoat is carried out The manufacture method of the lamination metal plate characterized by reaching [whether the pressure welding of the cooling roller is carried out, and], or injecting a cooling medium, and cooling beforehand, [0022] (4) Carry out the pressure welding of the sticking-by-pressure roll to the preheated metal plate which was twisted around the roll with a volume. In the method of flowing down the thermoplastics film fused from the T die through the extruder in the gap of a sticking-by-pressure roll and a metal plate, covering thermoplastics to a metal plate, and manufacturing a lamination metal plate While making larger than the width of face of a metal plate width of face of the thermoplastics film which flows down in the gap of a sticking-by-pressure roll and a metal plate, having it in the crosswise center section of the thermoplastics film and covering full [of a metal plate] In order to prevent that the thermoplastics film which flowed down more greatly than the width of face of a metal plate sticks to a roll with a volume, while injecting a gas from the hole in which the resin carried out opening to the roll front face with a volume of the portion by which the overcoat was carried out and making this resin film exfoliate from a roll with a volume While reaching [whether a resin carries out the pressure welding of the cooling roller for the crosswise both ends of the roll with a volume of a portion by which an overcoat is carried out, and], or injecting a cooling medium and cooling beforehand or a resin carries out the pressure welding of the cooling roller to the front face of the thermoplastics film of the portion by which the overcoat was carried out -- and -- or the manufacture method of the lamination metal plate characterized by injecting a cooling medium and cooling -- it comes out

[0023] Hereafter, this invention is explained in detail, referring to a drawing.

[0024] In this invention, a thick steel plate and a thick galvanized steel sheet, the zinc-alloy plating steel plate, a tin plated steel plate, a tin-alloy plating steel plate, an aluminum plating steel plate, an aluminium alloy plating steel plate, or a stainless steel board of board thickness etc. is first used as a metal substrate from the use used for building materials, such as a roof, a wall, and a partition, the charge of automobile material, the material of a home electrical-and-electric-equipment product, furniture, a can, etc.

[0025] Furthermore, what has an about 0.1-5micro chemical-conversion layer on this is contained.

[0026] In order that a chemical conversion may raise the corrosion resistance of a metal

substrate, oxidation resistance, and adhesion, it is performed as surface treatment of a metal plate, and is performed by phosphoric-acid zinc processing, phosphoric-acid iron processing, or the electrolytic chromate treatment.

[0027] Furthermore, after not performing a chemical conversion or performing a chemical conversion, what has an adhesives layer on this is contained.

[0028] An adhesives layer is a layer which applied about several [at least]micro adhesives, in order to improve the adhesion of a metal substrate and thermoplastics.

[0029] As these adhesives, the adhesive thermoplastics which has functional groups, such as a denaturation polyethylene resin, a denaturation epoxy resin, and denaturation vinyl resin, is suitable.

[0030] Adhesion is good for the both sides of a metal and the thermoplastics used for covering, for example, in the case of a polyolefine covering steel plate, a denaturation polyolefine like an ethylene-vinyl acetate copolymerization resin or an ethylene-acrylic-acid copolymerization resin is suitable for these.

[0031] The thermoplastics used for covering by this invention For example, a polyethylene-terephthalate resin, Polyolefin resin, acrylic resin, polyester resin, polyamide resin, Vinyl chloride resin, a fluororesin, polycarbonate resin, a polystyrene system resin, ABS plastics, a chlorinated-polyether resin, a urethane resin, etc. are typical. to polyolefin resin There are a polymer or copolymers, such as ethylene, a propylene, 1-butene, and 1-pentene. as acrylic resin There are a polymer or copolymers, such as an acrylic acid, a methacrylic acid, an acrylic ester, methacrylic-acid ester, and an acrylamide. to polyester resin There are a polyethylene terephthalate, oil free polyester, etc. to polyamide resin There are the so-called Nylon 66, nylon 6, Nylon 610, Nylon 11, etc. to vinyl chloride resin There is a copolymer with vinyl acetate, others, for example, ethylene, etc., and there are a polytetraflouoroethylene, a 3 ****-ized ethylene chloride resin, a 6 ****-ized ethylene propylene resin, ****-ized vinyl resin, ****-ized vinylidene resin, etc. in a fluororesin. [homopolymer]

[0032] Moreover, you may mix and use two or more resins. Moreover, the additive usually used at the time of film creation, for example, a degradation inhibitor, the modifier, the pigment, etc. may be included.

[0033] Moreover, in case it covers with a melting state, you may add cross linking agents, such as amino resin and an epoxy resin, in the range which does not lose a fluidity.

[0034] These thermoplastics is suitably chosen according to needs, such as weatherability, cold district fitness, thermal resistance, scratch-proof nature, resistance to contamination, chemicals-proof nature, and deep-drawing processability, according to the use of a surface treatment metal plate. For example, a polyolefine is excellent in cold resistance, a polyamide is excellent in abrasion resistance, acrylic resin is excellent in resistance to contamination or chemicals-proof nature, and it is excellent [a fluororesin] in weatherability etc.

[0035] The polyethylene-terephthalate resin is especially useful for an acid-proof use.

[0036] Monolayer covering or multilayer covering of a homotypic or a different-species resin is sufficient as a resin. In multilayer covering (for example, a multilayer T die), it can carry out, and a glue line can also be prepared between layers.

[0037] At an interlayer thermoplastics in the upper layer for an adhesive resin to a lower layer for example, by the three-layer T die [the steel plate which is applying and preheating adhesives] [the thermoplastics in a melting state] It can extrude in the shape of a film, and the surface treated steel sheet which carried out multilayer covering directly and continuously can be obtained. Or thermoplastics can be obtained in the 1st lower layer and the surface treated steel sheet which extruded thermoplastics in the shape of a film by the four-layer T die in the 4th best layer at the 3rd interlayer, and carried out multilayer covering of the adhesive resin directly and continuously can be obtained for the adhesive resin which is in the steel plate which is preheating at a melting state to the 2nd interlayer.

[0038] A drawing explains a manufacturing process below.

[0039] A metal substrate needs to precede covering a melting resin and it is necessary to preheat it.

[0040] For example, in the case of a polyethylene terephthalate, the preheating of -120 degrees C or more (therefore, about 135-255 degrees C) of melting points (255 degrees C) is desirable.

[0041] By carrying out a preheating, the fluidity of a resin increases and adhesion improves.

[0042] When, especially as for the time of a low, preheat temperature uses a cooling roller when not performing a preheating or, the adhesion of a resin is not enough and a result which lacks in corrosion resistance is brought.

[0043] Although the temperature of a preheating is so desirable that it is high since the fluidity of a resin increases, since a resin and adhesives will decompose if too high, it is not desirable. Moreover, it is not desirable from a viewpoint of energy saving.

[0044] Therefore, it is preferably carried out rather than the temperature of a melting resin below the temperature of a melting resin by 50-degree-C or more low temperature and the preheat temperature of about 50-230 degrees C of usual.

[0045] Drawing 1 carries out the pressure welding of the sticking-by-pressure roll 5 to the front face of the metal substrate 1 which twisted and was twisted around the roll 4 and which it preheated, flows down the thermoplastics film 3 fused from T die 2 through the extruder to the interface of the metal substrate front face and sticking-by-pressure roll 5, and shows the lamination metal plate manufacture method of ***** (ing) a thermoplastics film to the metal substrate 1.

[0046] Regulation of film ** or a surface state is easy for this method. For example, it is also easy regulation of surface gloss and to give an embossing pattern to a front face.

[0047] As for the metal substrate 1 with which the elevated-temperature melting resin 3 was covered, cooling ***** is performed. Even if cooling may perform a water spray for example, after air cooling and it makes it pass through a water-cooled tub, you may let a cooling roller pass.

[0048] Thus, in this invention, although the surface treatment metal plate of this invention is obtained, since the hole which carries out opening was prepared in the front face of the shaft-orientations portion of the roll with a volume which a thermoplastics film covers, the roll surface coating area of a resin decreases and, only in the part, the adhesion force on the front face of a roll of a resin decreases [effective-area integration].

[0049] Moreover, the resin film which covered the roll front face with a volume surfaces with a gas, without disturbing the thermoplastics film which flows down from a T die, since the gas feeder style which supplies a gas to the hole of opening which a thermoplastics film covers behind from a pressure-welding position was prepared.

[0050] Furthermore, since the gas which had between the surfacing resin film and roll front faces injected flows, while a resin film is cooled, a roll front face is also cooled and the adhesion force on the front face of a roll of a resin decreases further.

[0051] Drawing 3 is the direction view [in / drawing 3 / respectively / in the cross section of equipment, drawing 4, and 5 and 6] of X-X, the direction view of Y-Y, and Z-Z direction view.

[0052] As shown in drawing 3 and 4, this invention is the front face of the roll 4 with a volume (roll volume attachment) which the preheating metal plate 1 coils and is passed. As opposed to the thermoplastics which makes width of face WP of thermoplastics 3 larger than the board width WM of a metal plate 1, and covers opening of a roll front face with a volume The hole which carries out opening to the shaft orientations of the portion to cover is prepared, and a gas is injected [position / pressure-welding / of a nip roll (sticking-by-pressure roll) 5] from a hole in the back section.

[0053] Drawing 3 shows having formed the wind box which slides on this roll inner skin as a method of supplying a gas to the hole.

[0054] Moreover, although the gas is injected from the pressure-welding position of a nip roll 5 in drawing 3 in the field in which a metal plate 1 separates from the roll 4 with a volume behind, a wind box is extended, also about the roll front face with a volume which thermoplastics has not covered, if a gas is made to inject, a roll skin temperature can be made to be able to fall more and cooling of the thermoplastics which covered the roll front face can be promoted.

[0055] Furthermore, if a wind box is made into block construction by the circumferencial direction, strength can be attached to gaseous injection or the injection pattern of a finer gas can be realized.

[0056] However, the position which injects a gas needs to select a proper position by the thermoplastics flowing down, warning against the thermoplastics of the melting state which flows down from a T die not shaking, or making it a position which will be in the state where it cannot stabilize and flow down.

[0057] Drawing 5 shows having formed the hole 10 penetrated in the roll thickness direction with a volume into the portion which lines thermoplastics and detachability good rubber 52, for example, poly 4 ****-ized ethylene rubber, and thermoplastics covers in the periphery of the metal sleeve 51.

[0058] Furthermore, supply of the gas to this hole forms the wind box 9 which slides on the inner skin of a roll, and a gas is supplied to this wind box by the gas supply pipe 61.

[0059] In addition, this wind box is connected with a part for a shank by the socket 56, and since it is pressed against the inner skin of a roll with the spring 58 inserted into the socket, there is little leakage at bulb of the gas to inject.

[0060] Furthermore, the axial structure of this equipment is the double-pipe structure of an outer tube 55 and a shaft 54, and moving part 53 is between this outer tube and a shaft. The slot 63 can be open to shaft orientations at the outer tube, and a socket 56 can move now to shaft orientations.

[0061] When the move mechanism is shown, this moving part and shaft are in the relation between a nut and a bolt, and if a shaft rotates, moving part will move in connection with it.

[0062] That is, if a shaft is rotated, a wind box is movable to shaft orientations with a socket. Therefore, it can respond now to change of the board width of a metal plate which carries out plate leaping.

[0063] Moreover, the injection width of face of the wind box in the direction of roll axis with a volume can inject the gas to inject to thermoplastics effectively, if it is made the same as the resin width of face of the thermoplastics which covers a roll front face.

[0064] In addition, a shaft is fixed and this equipment has structure which only a sleeve 51 rotates through bearing 59.

[0065] Drawing 6 shows the position of the hole which carries out opening. As for the hole which carries out opening, it is good to prepare in the field to the resin width of face WPmax of the thermoplastics which covers the roll front face in the maximum board width WMmax from the minimum board width WMmin of the metal plate by which plate leaping is carried out.

[0066] The enlarged view of the portion of a hole is shown in drawing 7. About the form of a hole, what configuration is sufficient as a round shape, a square type, a rectangle type, a rhombus, etc.

[0067] Moreover, about arrangement of a hole, as shown in drawing 7, in order to lessen roll surface coating area of thermoplastics, it is good to make it as dense as possible and to arrange.

[0068] Furthermore, the U-U cross section in drawing 7 is shown in drawing 8 and 9 about the structure of a hole. As shown in drawing 8 and 9, in order to reduce the roll surface coating area of thermoplastics, injecting a gas with sufficient vigor, the structure which makes the aperture by the side of a roll front face larger than the aperture by the side of a roll inside,

for example, two-step hole structure, (drawing 8), and tapered-bore structure (drawing 9) are good.

[0069] Moreover, about the size of the hole on the front face of a roll, as shown in drawing 10, in order to avoid that thermoplastics is poured into a hole by the pressure welding, it is good [it is a pressure-welding position with a nip roll, and] to make it a bigger hole than the nip width of face of a nip roll, as shown in drawing 11.

[0070] Although the old example makes the hole the breakthrough, as shown in drawing 12 - 13, it is good also as a non-breakthrough. As for the supply direction of the gas at this time, it is good to consider as a roll front face or a roll end face.

[0071] Or it slides the method and gas charging line which set a nozzle and arrange a hole and a gap as the supply method of the gas to inject in addition to a wind box directly and arranges, there is the method of setting and arranging a gap etc.

[0072] Furthermore in this invention, the resin which carried out the overcoat is sprayed in a cooling medium. Or a cooling medium is injected and it cools beforehand. or -- or it carries out the pressure welding of the cooling roller or a resin carries out the pressure welding of the cooling roller for the crosswise both ends of the roll with a volume of a portion by which an overcoat is carried out -- and -- It is made easy to promote cooling and solidification of a resin, to reduce the adhesion force of a roll front face with a volume, and an overcoat resin, and to exfoliate from a roll with a volume by using together these two or more methods.

[0073] If the temperature of a resin is high, it is sticky, it attaches and is easy to adhere to a roll with a volume, and since the resin itself is soft, it will be torn off and will coil around a roll with a volume.

[0074] Moreover, it is made easy to reduce the adhesion force with a resin, and to promote cooling and solidification of a resin, although it is indirect, and to exfoliate from a roll with a volume by lowering the temperature of a roll front face with a volume.

[0075] Next, a drawing explains this.

[0076] a roll with a volume when drawing 15 injects a cooling medium through a cooled nozzle 11 on the front face of the thermoplastics film 3 and it cools -- a cooled nozzle -- and -- or while cooling by the cooling roller, it is explanatory drawing explaining the case where a gas injection is performed It may replace with a cooled nozzle or a cooling roller may be used simultaneously.

[0077] As a cooling medium, **** (the shape of a fog), liquid nitrogen, etc. which air mixed with air, water, and water are suitable from economical efficiency or refrigeration capacity.

[0078] Moreover, a screen is prepared in the edge of a metal plate and you may make it a cooling medium not start a metal plate so that the metal plate itself may not be cooled.

[0079] In addition, the roll with a volume has a product made from Teflon, or a desirable product made from silicon, in order to lessen adhesion of a resin.

[0080] Moreover, as a cooling roller, a point to the copper or iron of the cooling effect is suitable.

[0081] Thus, by using together a gas-injection roll and cooling of an overcoat resin, it is stabilized and high speed operation of about 100 m/min can be performed now.

[0082] An example explains below.

[0083]

[Example 1] Finally, the example which used this equipment is explained.

[0084] When the metal plate 1 which the outside surface of the metal sleeve 51 preheated in equipment as shown in drawing 14 as a roll which has twisted the metal plate with the roll 4 with a volume which covered poly 4 ****-ized ethylene rubber 52 coils, the roll 4 with a volume which prepared the hole penetrated from the interior of a roll to the exterior in the shaft orientations of a roll installed near [where the resin protruded from the board contacts] the roll surface portion.

[0085] Furthermore, when the pressure welding of the roll 4 with a volume and the nip roll 5

was carried out, the wind box 9 was installed so that air might spout only from the field A of the point ending [metal plate coiling-round] just behind a pressure-welding portion.

[0086] Thus, after preheating a metal plate 1, extrude the PET system resin 3 to the interface of a metal plate 1 and a nip roll 5, it was made to flow down from T die 2, and the metal plate 1 was made to cover. At this time, the PET system resin 3 was widely covered every 50mm on both sides from the metal plate 1.

[0087] And without coiling around the roll 4 with a volume, the resin which protruded the PET system resin 3 into it from the metal plate 1 when air was made to blow off from the breakthrough of the roll 4 with a volume to a metal plate 1 immediately after a covering start exfoliated, and checked that line speed was stabilized to 20 m/min and it could operate.

[0088] The air jet hole was used for the front face of the resin which furthermore carried out the overcoat after the pressure welding, and air was sprayed before the metal plate coiling-round end.

[0089] Moreover, the resin used the air jet hole for the roll front face with a volume of the portion by which an overcoat is carried out, carried out surface contact of the cooling roller of spraying and an internal water-cooled method with an outer diameter of 50mm for air, and cooled the roll front face with a volume.

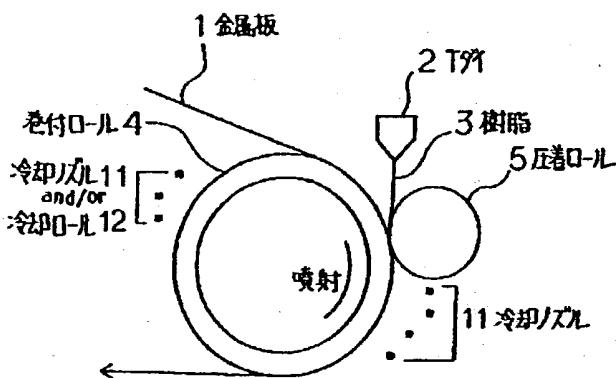
[0090] Without having twisted and adhering to a roll, also at the high speed of 100 m/min, it was stabilized and the overcoat resin has been operated.

[0091] As an example of comparison, when it operated without using the roll which blows off this air in the above-mentioned example, the resin protruded from the metal plate coiled around the roll which has twisted the metal plate immediately, and operation of it became impossible.

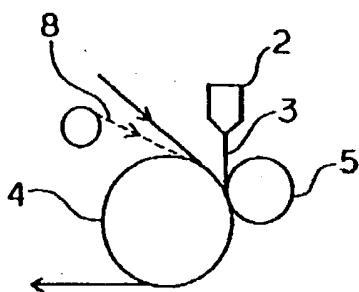
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

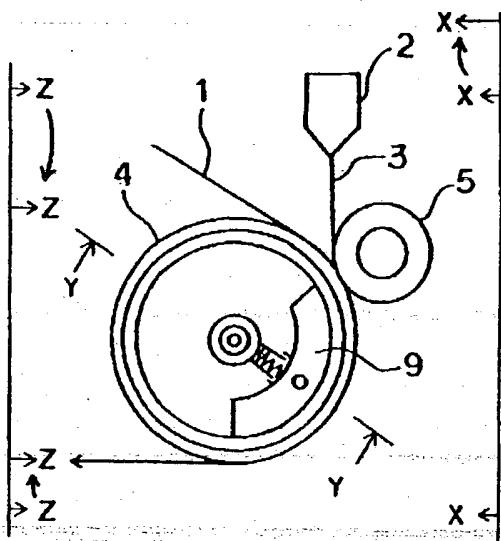
[Drawing 1] It is explanatory drawing of the method of covering by flowing down a melting resin to the interface of a metal substrate and a roll.



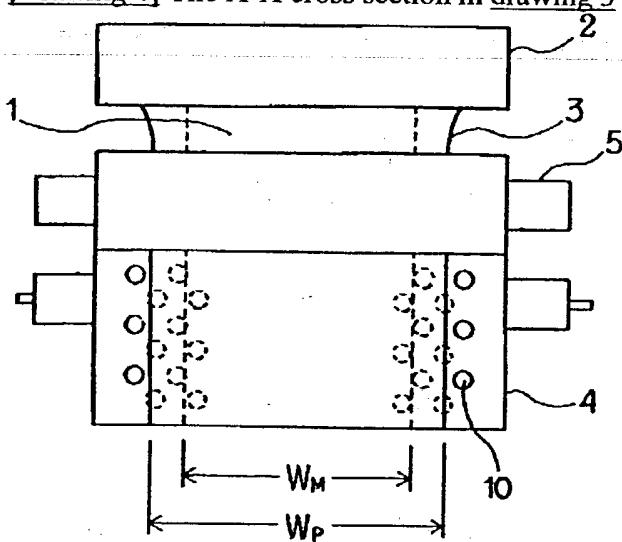
[Drawing 2] Explanatory drawing of the T die extrusion method using ***** material.



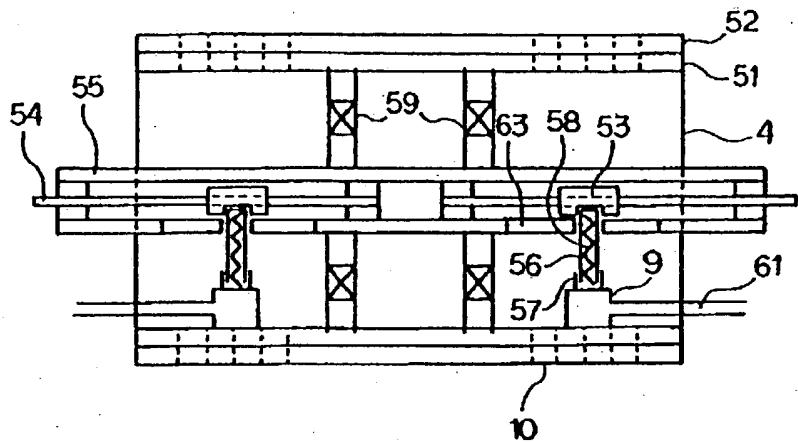
[Drawing 3] Explanatory drawing of this invention method.



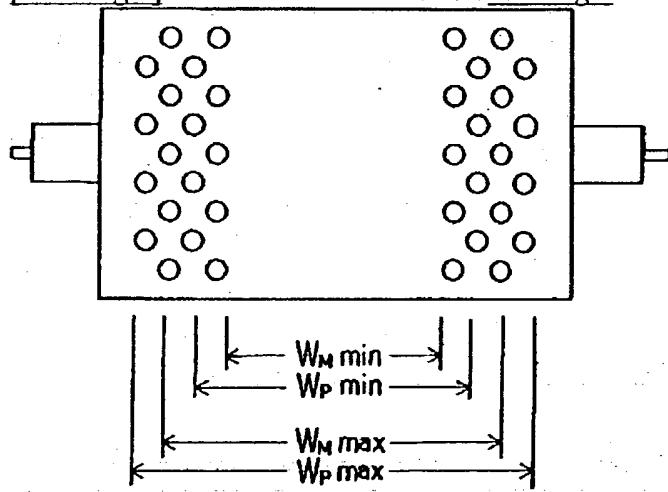
[Drawing 4] The X-X cross section in drawing 3.



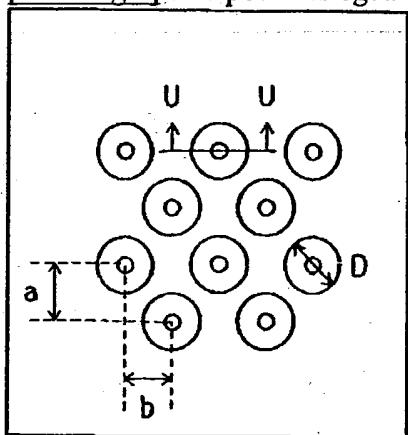
[Drawing 5] The Y-Y cross section in drawing 3.



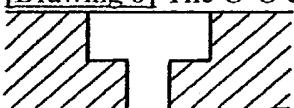
[Drawing 6] The Z-Z cross section in drawing 3 .



[Drawing 7] The pore enlarged view in drawing 6 .



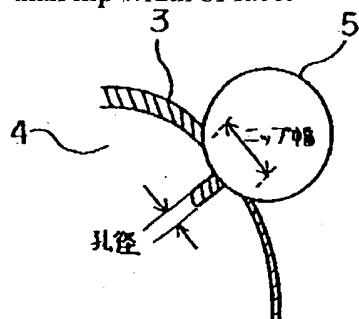
[Drawing 8] The U-U cross section in drawing 7 (two-step hole type).



[Drawing 9] The U-U cross section in drawing 7 (taper type).

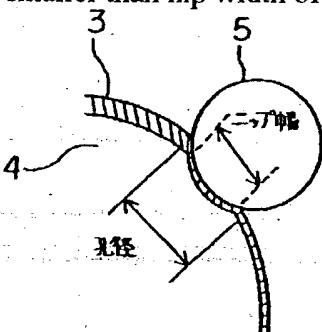


[Drawing 10] The cross section of the nip-roll pressure-welding section with a larger aperture than nip width of face.



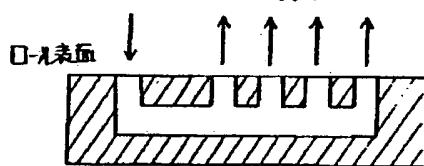
(孔径 < 二, 7φ)

[Drawing 11] The cross section of the nip-roll pressure-welding section with an aperture smaller than nip width of face.

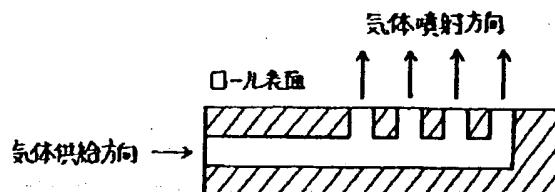


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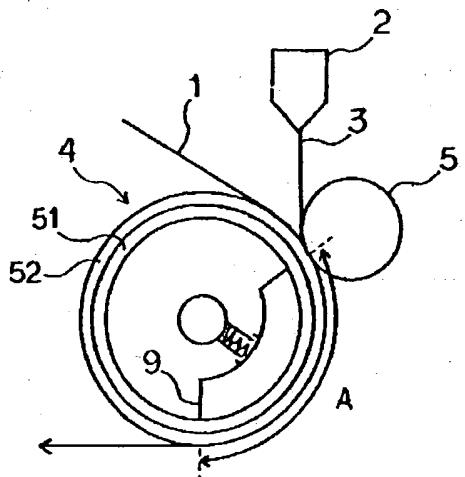
[Drawing 12] Explanatory drawing showing the embodiment of a gas injection.
气体供给方向 气体喷射方向



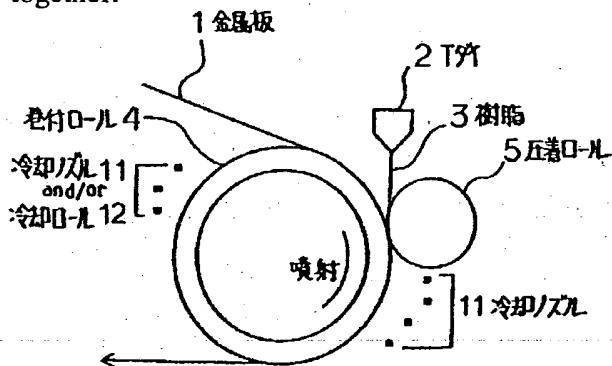
[Drawing 13] Explanatory drawing showing the embodiment of a gas injection.



[Drawing 14] Explanatory drawing of an example 1.



[Drawing 15] Explanatory drawing of this invention which used cooling and the gas injection together.



[Description of Notations]

- 1 Metal Plate
- 2 T Die
- 3 Thermoplastics
- 4 Twist and it is Roll.
- 5 Sticking-by-Pressure Roll
- 6 Cooling System
- 7 Water Spray Cooling System
- 8 ***** Material
- 9 Wind Box
- 10 Breakthrough
- 51 Metal Sleeve
- 52 Rubber Lining
- 53 Moving Part
- 54 Shaft

55 Outer Tube (Sleeve)

56 Socket

57 Plug

58 Spring

59 Bearing

61 Gas Supply Pipe

63 Slot

11 Cooled Nozzle

12 Cooling Roller

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